

ABSTRACT OF THE DISCLOSURE

Methods of fabricating uniform nanotubes are described in which nanotubes were synthesized as sheaths over nanowire templates, such as using a chemical vapor deposition process. For example, single-crystalline zinc oxide (ZnO) nanowires are utilized as templates over which gallium nitride (GaN) is epitaxially grown. The ZnO templates are then removed, such as by thermal reduction and evaporation. The completed single-crystalline GaN nanotubes preferably have inner diameters ranging from 30 nm to 200 nm, and wall thicknesses between 5 and 50 nm. Transmission electron microscopy studies show that the resultant nanotubes are single-crystalline with a wurtzite structure, and are oriented along the $\langle 001 \rangle$ direction. The present invention exemplifies single-crystalline nanotubes of materials with a non-layered crystal structure. Similar "epitaxial-casting" approaches could be used to produce arrays and single-crystalline nanotubes of other solid materials and semiconductors. Furthermore, the fabrication of multi-sheath nanotubes are described as well as nanotubes having multiple longitudinal segments.